

I CLAIM:

- 1 1. A system for automatic and seamless vertical roaming (SVR) between a wireless local
2 area network (WLAN) and a wireless wide area network (WWAN) while maintaining an
3 active voice or data communication:
 - 4 (a) a mobile station for WWAN and WLAN transmissions to the WLAN and the
5 WWAN network;
 - 6 (b) a WLAN gateway linked to the mobile station by a WLAN bi-directional
7 communication link and operating in the Global System Mobile (GSM)/General
8 Packet Radio Service (GPRS) or IEEE 802.11 modes;
 - 9 (c) a base transceiver station operating in the GSM GPRS modes for servicing the
10 WWAN and linked to the mobile station by a WWAN bi-directional
11 communication link;
 - 12 (d) a switched network including a mobile switching center connected to the WLAN
13 gateway and the base transceiver station; and
 - 14 (f) WLAN command apparatus to initiate transfer of traffic between the mobile
15 station and a remote user on the WLAN via the gateway to the WWAN when
16 signal degradation occurs.

1 2. The system of Claim 1 further comprising:
2 (g) WWAN command apparatus to initiate transfer of traffic between the mobile
3 station and a remote user via the WWAN to the gateway to the WLAN when the
4 mobile station enters the WLAN area.

1 3. The system of Claim 1 further comprising:
2 (h) a dual mode radio for SVR switching between the WWAN and the WLAN and
3 vice versa as a user travels between the networks.

4. The system of Claim 1 further comprising:
(i) a mobile switching center providing an Explicit Call Transfer (ECT) function for
SVR switching between WLAN/WWAN networks.

5. The system of Claim 1 further comprising:
(j) WLAN signaling apparatus for interleaving WLAN signaling in vacant
GSM/GPRS traffic slots.

1 6. The system of Claim 1 further comprising:
2 (k) traffic apparatus for interleaving WLAN/WWAN voice/data traffic in vacant
3 GSM/GPRS signaling slots.

1 7. The system of Claim 1 further comprising:
2 (l) An SVR interface linking a dual mode radio API with a GSM/GPRS protocol stack
3 and a WLAN IEEE 802.11 protocol stack.

1 8. The system of Claim 7 wherein the SVR interface further comprises a three-layer
2 communication interface.

1 9. The system of Claim 1 further comprising:
2 a jitter buffer in the WLAN to transform random packet arrival times into uniformly
3 spaced streaming data.

1 10. The system of Claim 1 further comprising:
2 circuit switching apparatus between the WWAN and the WLAN for maintaining a
3 connection between parties on the WWAN and the WLAN when transferring from WWAN to
4 the WLAN and vice versa.

1 11. A method for automatic and seamless vertical roaming between a wireless local area
2 network (WLAN) and a wireless wide area network (WWAN) while maintaining an active voice
3 or data connection comprising the Steps of:

4 (a) issuing a command to the WWAN by a mobile station including a dual
5 mode Radio capable of WWAN and WLAN transmission, the command
6 initiating transfer of a voice or data call on the WWAN to a remote party
7 on the WLAN;

- 8 (b) checking whether or not a gateway is linked to the dual mode Radio for
9 WLAN transmissions while maintaining the call between the remote party
10 and the mobile station;
- 11 (c) verifying by the dual mode Radio that the caller identification is from a
12 WWAN transmission and signaling the WLAN gateway to accept the call;
- 13 (d) storing the packets at the mobile station while waiting for the
14 establishment of a WLAN connection;
- 15 (e) dropping the WWAN transmission for the call by the WWAN network;
16 and
- 17 (f) connecting the caller via the gateway and releasing the stored packets to
18 the dual mode Radio for WLAN transmission.

1 12. A method for automatic and seamless vertical roaming between a wireless local area
2 network (WLAN) and a wireless wide area network (WWAN) while maintaining an active voice
3 or data connection comprising the steps of:

- 4 (a) issuing a command to the gateway by a mobile station including a dual
5 mode Radio capable of WWAN and WLAN transmission, the command
6 initiating transfer of a VoIP call or data communications on the WLAN to
7 a remote party on the WWAN;
- 8 (b) checking by the WWAN network whether or not the dual mode Radio for
9 WWAN transmissions is registered to the WWAN network while
10 maintaining the call between the remote party and the mobile station;

- 11 (c) verifying by the dual mode Radio that the caller identification is from a
12 WLAN transmission and signaling the WWAN network to accept the call;
13 (d) storing the packets at the mobile station while waiting for the
14 establishment of the WWAN connection;
15 (e) dropping the WLAN transmission for the call by the WLAN network; and
16 (f) connecting the caller to the mobile station via the WWAN network and
17 releasing the stored packets to the dual mode Radio for WWAN
18 transmissions.

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13. The method of Claims 11 and 12 further comprising:
- (g) initiating transfer of traffic between the mobile station and a remote user via the WWAN to the WLAN when the mobile station enters the WLAN area.
14. The method of Claims 11 and 12 further comprising:
- (h) switching a dual mode radio between the WWAN and the WLAN and vice versa as a user travels between the networks.

1 15. The method of Claims 11 and 12 further comprising:
2 (i) providing an Explicit Call Transfer (ECT) function for SVR switching
3 between WLAN/WWAN networks when a user roams in the networks.

1 16. The method of Claims 11 and 12 further comprising:
2 (j) interleaving WLAN signaling in vacant GSM/GPRS traffic slots.

1 17. The method of Claims 11 and 12 further comprising:
2 (k) interleaving WLAN/WWAN voice/data traffic in vacant GSM/GPRS
3 signaling slots.

1 18. The method of Claims 11 and 12 further comprising:
2 (l) linking a dual mode radio API with a GSM/GPRS protocol stack and a
3 WLAN IEEE 802.11 protocol stack for SVR between WWAN and
4 WLAN and vice versa.

1 19. The method of Claim 18 wherein the SVR interface further comprises a three-layer
2 communication interface.

1 20. The method of Claims 11 and 12 further comprising:
2 transform random packet arrival times into uniformly spaced streaming data using a jitter
3 buffer.

1 21. The method of Claims 11 and 12 further comprising:
2 maintaining a connection between parties on the WWAN and the WLAN when
3 transferring from WWAN to the WLAN and vice versa.

1 23. A medium, executable in a computer system for automatic and seamless vertical roaming
2 between a wireless local area network (WLAN) and a wireless wide area network (WWAN)
3 while maintaining an active voice or data connection comprising:

- 4 (a) program instructions issuing a command to the WWAN by a mobile
5 station including a dual mode Radio capable of WWAN and WLAN
6 transmission, the command initiating transfer of a voice or data call on the
7 WWAN to a remote party on the WLAN;
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9 (b) program instructions checking whether or not a gateway is linked to the
10 dual mode Radio for WLAN transmissions while maintaining the call
11 between the remote party and the mobile station;
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13 (c) program instructions verifying by the dual mode Radio that the caller
14 identification is from a WWAN transmission and signaling the WLAN
15 gateway to accept the call;
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17 (d) program instructions storing the packets at the mobile station while
18 waiting for the establishment of a WLAN connection;
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20 (e) program instructions dropping the WWAN transmission for the call by the
21 WWAN network; and
22
23 (f) program instructions connecting the caller via the gateway and releasing
24 the stored packets. to the dual mode Radio for WLAN transmission.

1 24. A medium, executable in a computer system for automatic and seamless vertical roaming
2 between a wireless local area network (WLAN) and a wireless wide area network (WWAN)
3 while maintaining an active voice or data connection comprising:

- 4 (a) program instructions issuing a command to the gateway by a mobile station
5 including a dual mode Radio capable of WWAN and WLAN transmission, the
6 command initiating transfer of a VoIP call or data communications on the WLAN
7 to a remote party on the WWAN;
- 8 (b) program instructions checking by the WWAN network whether or not the dual
9 mode Radio for WWAN transmissions is registered to the WWAN network while
10 maintaining the call between the remote party and the mobile station;
- 11 (c) program instructions verifying by the dual mode Radio that the caller
12 identification is from a WLAN transmission and signaling the WWAN network to
13 accept the call;
- 14 (d) program instructions storing the packets at the mobile station while waiting for
15 the establishment of the WWAN connection;
- 16 (e) program instructions dropping the WLAN transmission for the call by the WLAN
17 network; and
- 18 (f) program instructions connecting the caller to the mobile station via the WWAN
19 network and releasing the stored packets to the dual mode Radio for WWAN
20 transmissions.